Chapter 5

Electrical Contractor

Besides installing the electrical system for Super Good Cents homes, the electrical contractor may be responsible for heating, lighting, and ventilation systems. If the home plan includes energy efficient lighting options, Super Good Cents specifications affect the type of fixtures and controls that are installed.

Super Good Cents ventilation specifications require higher quality fans and more sophisticated controls than code in many areas. This chapter explores the major differences between Super Good Cents homes and standard construction that affect the electrical contractor.

INSULATING RECESSED FIXTURES IN INSULATED WALLS

Service Panel Location/Panel Insulation

To reduce thermal losses through the wall insulation system, keep the service panel out of walls that will be insulated, if possible. If you must place the service on a wall that will be insulated, Super Good Cents specifications require at a minimum 2-inch rigid (R-10) foam insulation behind the box. It is easiest to place rigid foam into the wall cavity before the service box is installed.

Wall Heaters

If wall heaters are in insulated walls, LTSGC specifications also call for a minimum of R-10 rigid foam behind heating fixtures. It is easiest to place rigid foam into the wall cavity before the heater box is installed.

ZONAL HEATING SYSTEMS

The electrical contractor typically is responsible for installing zonal electric heating systems such as baseboards, wall mounted heaters and radiant heaters. In well insulated, tightly constructed, energy efficient homes, appropriately sized zonal heating systems provide high levels of comfort and efficiency. Zonal systems are not plagued by the 20 to 30 percent duct losses that reduce forced air system efficiency, and zonal systems provide the flexibility to heat only occupied areas of a home while maintaining lower temperatures in unoccupied areas.

Oversizing zonal units wastes money and increases the connected load of a home. Some Super Good Cents utilities have established sizing requirements based on heat load calculations. Check with the local utility before buying equipment.

If you do not know how to do room-by-room heat loss calculations and want to learn, utilities, code jurisdictions, state energy offices, and Extension Service offices can provide instructional materials and forms.

Controls for Zonal Heating Systems in Super Good Cents Homes

1994 LTSGC 3.2.2

1. Wall-mounted thermostats must be installed in each zone. Thermostats mounted on baseboards or wall heaters are not acceptable.
2. Thermostats must have numerical degree settings.
3. Thermostats must be heat anticipating or electronically controlled.

LIGHTING

Special Requirements for Recessed Lights

1994 LTSGC 2.5

Super Good Cents lighting specifications aim to eliminate thermal losses associated with insulation breaks around recessed light fixtures. Recessed lights must be insulated to the full R-value of the ceiling in which they are installed. If full R-value above a fixture is not possible, Super Good Cents specifications allow up to 1 percent of a ceiling area to be insulated with a minimum R-10 rigid foam board.

Because fixtures will be covered with insulation, for fire safety reasons they must be IC (insulation cover) rated.

Acceptable fixtures include:

1. IC rated (but not air leakage tested), double can units sealed around the exterior to be airtight; or
2. IC rated or fluorescent fixtures installed in a site-built “box” that extends the ceiling air barrier above the light fixture; or
3. IC rated fixtures certified under ASTM E-283 to have no more than 2.0 CFM air leakage. The certified fixture shall be tested without trim at 75 Pascals or 1.57 lb/ft^2 pressure difference and have an attached label showing compliance.

Efficient Lighting Option

In some instances the general contractor has an agreement with the participating Super Good Cents utility to install optional energy efficient lighting. Even though it is an option, lighting equipment specifications and design requirements must be met if they are part of the agreement with the utility. Hopefully the general contractor will have informed the electrical contractor about lighting option requirements. Optional equipment may include interior lighting and/or outside/common area lighting for both single and multifamily projects.

Interior Lighting Option

To meet optional interior lighting specifications:

1. One general luminaire with a lamp efficacy of at least 50 lumens per watt (fluorescent fixture) must be installed. The general luminaire must be switched at the room entrance. The general luminaire shall not be capable of accepting medium base Edison incandescent lamps. The color rendition index (CRI) of the lamp shall not be less than 79. The CRI requirement means that common warm /cool white fluorescent lamps do not qualify. Additional luminaires for task lighting or decorative effects need not meet these efficacy and color requirements, but must be controlled by their own switches, independent from the general light.
2. The total wattage of kitchen luminaires must not exceed 2 watts per square foot of kitchen floor area. Wattage of kitchen range hood luminaires is excluded from this budget. If you exceed the kitchen lighting budget, reduce wattages by using more efficient fixtures and luminaires.

Outdoor/Common Area Lighting

Special lamps, fixtures, or controls are needed to meet the optional outside/common area lighting specifications.

1. No more than four luminaires per single family unit or four luminaires per multifamily unit may be installed. Luminaires for multifamily units may be allocated to outdoor or common areas as desired.
2. Luminaires shall have minimum efficacies of 50 lumens per watt (compact fluorescent, metal halide, or high pressure sodium fixtures). Fixtures shall not be capable of accepting medium base Edison incandescent lamps.
3. Outdoor luminaires shall be rated for use in damp locations. Luminaires in outdoor fixtures shall use lamps capable of starting at 0°F.
4. Outdoor luminaires shall be switched at the entrance to the single family or multifamily unit or shall be automatically controlled. Outdoor luminaires

operating on photocells shall be limited to metal halide, high pressure sodium, or compact fluorescents of 9 watts or more. Outdoor luminaires controlled by ultrasonic or infrared motion detectors are exempt from the efficacy requirement.

SUPER GOOD CENTS VENTILATION SYSTEMS

1994 LTSGC 4.3

General Description

Whole House Plus Spot Ventilation

In many Super Good Cents homes, the electrical contractor installs the ventilation system—special exhaust fans and controls that work in concert with fresh air vents installed by the framers. In other cases, central, ducted heat recovery ventilation systems may be installed under the direction of the HVAC contractor.

Ventilation systems in Super Good Cents homes must provide whole house as well as spot ventilation capacity. The overall goal is to install residential and multifamily systems that meet ASHRAE 62-1989, “Standard for Acceptable Indoor Air Quality.” The ASHRAE residential standard prescribes a minimum 15 CFM per person or 0.35 air changes per hour, whichever is greater.

Balanced Systems

Fans installed by the electrical contractor work in concert with fresh air inlets in windows or installed through the wall by framers. As exhaust fans pull stale air out of the home, they pull fresh air in through air inlets.

Fan CFM Requirements

Super Good Cents specifications list minimum (and maximum) fan CFM ratings for achieving prescribed whole house ventilation rates. Required CFM ratings depend on house size and mode of operation (continuous vs. intermittent). In general, intermittent systems require higher fan CFM ratings because run times are shorter; continuous systems require lower fan CFM ratings because run times are longer. Larger residences require higher CFM ratings than smaller residences.

Do Not Overdo It

While it is important to meet minimum ventilation requirements, it is equally important not to overdo it. Too much ventilation creates unnecessary energy penalties

and can cause health and safety problems in tight homes with naturally vented combustion appliances.

Controls and Run Times

The designated whole house fan in some homes is automatically controlled to run intermittently at least 8 hours a day. In other homes and many multifamily projects, the whole house fan operates continuously.

Noise

Because of longer run times, quiet (low sone) high quality fans are required to minimize fan noise. If the whole house fan does not have the required sone rating, it must be replaced.

Requirements for sound attenuation between fan canisters and framing and acceptance of remote mount systems are other examples of the Super Good Cents program's emphasis on quiet, high quality ventilation. See Figure 5A. With their low sone ratings and sound attenuation, you should not be able to tell when ventilation fans come on.

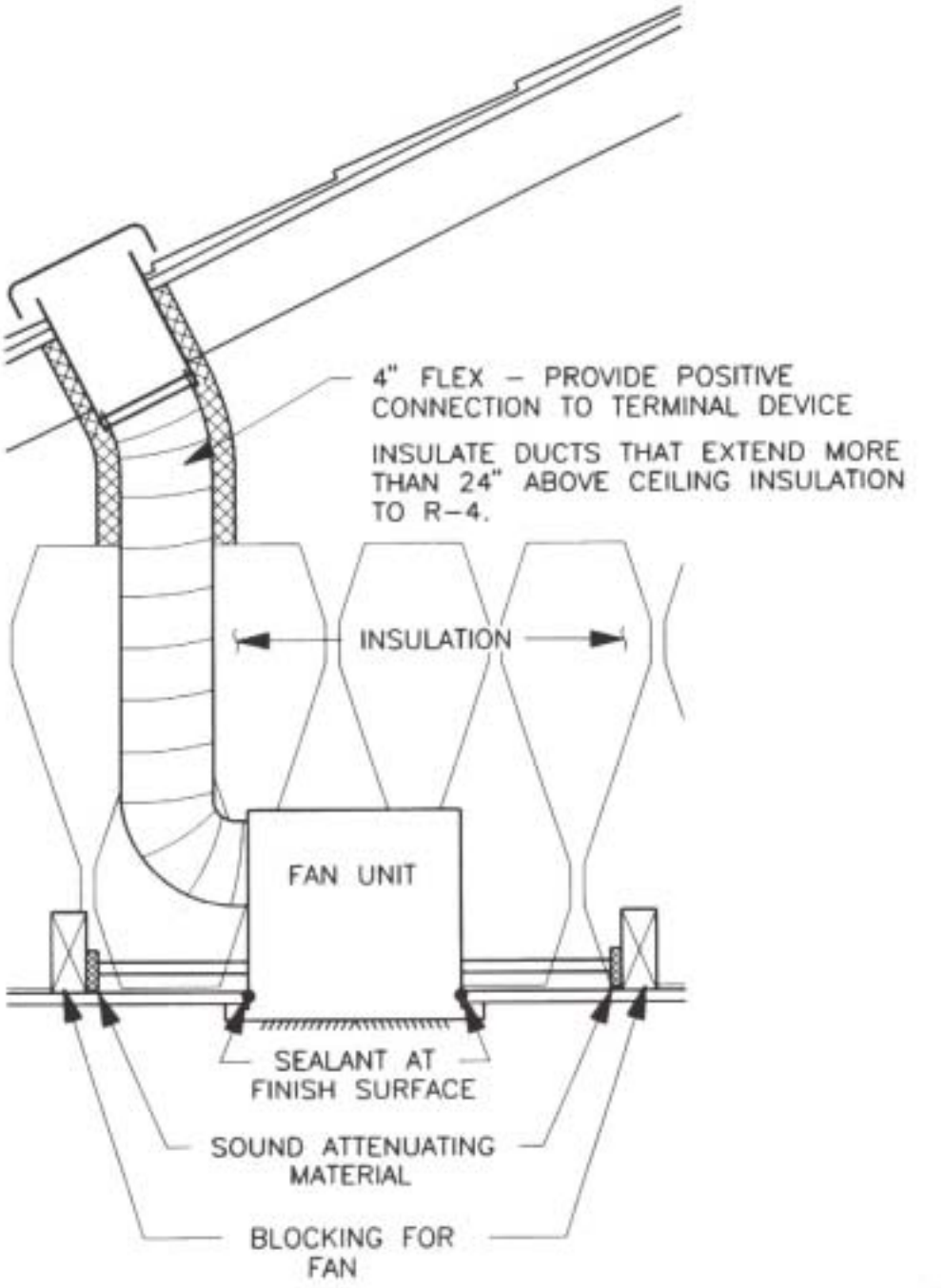
Fan Ducts

Installing the right fan is the first step in achieving effective whole house or spot ventilation. The next step is correct installation of the duct between the fan and outdoors. Super Good Cents specifications address minimum fan duct diameters, maximum duct lengths, maximum number of fittings, and size of termination devices. Most fans installed today lose a third to half of their rated ventilation capacity because the fan duct is too long, the duct material provides too much resistance to airflow, the termination fitting is too small, or there are too many directional changes (fittings) in the duct run. In some cases, screws used to connect the duct to the fan collar are too long and prevent the fan damper from opening.

Many Approaches

Drawings in this chapter show several approved ventilation systems for Super Good Cents homes. Other approaches may be used if locally approved, as long as they meet the intent of program ventilation specifications. Ask the general contractor or Super Good Cents utility representative what ventilation approach will be used, so you can be sure you are purchasing and installing the right equipment.

Figure 5A
SOUND ATTENUATION FOR SURFACE MOUNTED FANS



Whole House Ventilation Specifications

LTSGC 4.3

SUPER GOOD CENTS SONE RATINGS FOR WHOLE HOUSE FANS

Fan Type Systems	Continuous Systems	Intermittent
Surface Mount Fans	1 sone or less	1.5 sones or less
Remote Mount Fans	No requirement	No requirement

Note:

Surface mount - Exhaust fan motors within 4 ft of the pickup grill

Remote mount - Exhaust fan motors more than 4 ft from the pickup grill

Table 5.1

EXHAUST DUCT LENGTH VS. DIAMETER

LTSGC 4.3.1, Table C

Fan CFM 0.25" w.g.	Max. #90° elbows	Flex Duct		Smooth Duct	
		Min. Diameter	Max. Length	Min. Diameter	Max. Length
50	3	4"	25	4"	70
50	3	5"	90	5"	100
50	3	6"	no limit	6"	no limit
80	3	4" not allowed	—	4"	20
80	3	5"	15	5"	100
80	3	6"	90	6"	no limit
100	3	5" not allowed	—	5"	50
100	3	6"	45	6"	no limit
125	3	6"	15	6"	no limit
125	3	7"	70	7"	no limit

For each elbow over three, subtract 10 feet from the maximum duct length.

To prevent condensation inside metal fan ducts and “drip-back” inside the home, fan ducts must be wrapped with a minimum R-4 insulation.

Ventilation Approaches for Multifamily Units (6 or more units)

Any of the following whole house ventilation systems are approved for use in multifamily housing: 1) Multifamily Continuous Ventilation; 2) Multifamily Intermittent Ventilation; or 3) Multifamily Intermittent Ventilation Integrated With Ducted Forced Air System.

Multifamily Continuous Ventilation

Table 5.2 shows minimum (and maximum) fan CFM ratings for continuous ventilation systems in multifamily buildings. Table 5.2 CFM minimums apply when only the whole house fan provides whole house ventilation and separate spot ventilators serve the baths and kitchen.

Table 5.2
CONTINUOUS VENTILATION RATES FOR MULTIFAMILY CONSTRUCTION

LTSGC 4.3, Table A

Number of Bedrooms	Minimum Certified Fan Flow @ 0.25" w.g.	Maximum Certified Fan Flow @ 0.25" w.g.
1	30 CFM	60 CFM
2	50 CFM	75 CFM
3	60 CFM	90 CFM
4	80 CFM	120 CFM

If a whole house fan provides whole house ventilation and continuous spot ventilation in the bathrooms and kitchen, replacing spot ventilation fans at those locations, whole house fan capacity must be sufficient to exhaust a minimum of 20 CFM per bathroom and a minimum of 25 CFM from the kitchen. For example, if a continuous fan provides whole house and continuous spot ventilation in a residence with two baths and a kitchen, the minimum whole house fan capacity is 65 CFM.

Multifamily Intermittent Ventilation

Intermittent whole house ventilation systems in multifamily residences must be sized to provide 1.5 times the fan capacity in Table 5.2. A central intermittent system may replace spot ventilators if the central system is sized to meet minimum intermittent spot ventilation requirements: 50 CFM per bathroom and 100 CFM for the kitchen.

Controls for intermittent systems include a 24-hour timer with a manual switch capable of setting two ventilation periods for a total minimum ventilation period of 8 hours per day. If the whole house fan provides whole house and spot ventilation, the fan must be controlled in parallel by a 24-hour timer and manual switches in the baths and kitchen.

Multifamily Intermittent Ventilation Integrated With Ducted Forced Air System

The ventilation system may be integrated with the heating/cooling system only if each multifamily unit has a separate forced air system. Installation of this type of system needs to be coordinated with the HVAC contractor. The electrical contractor may provide a 24-hour timer, the exhaust fan, and a 24-volt control circuit for the furnace fan and motorized damper. The HVAC contractor may provide the final furnace and damper hookups.

The whole house exhaust fan must meet multifamily CFM requirements (continuous or intermittent), be controlled by a 24-hour timer with a manual override switch, and be set to provide a minimum ventilation period of 8 hours per day. The 24-hour timer also controls the furnace fan and a motorized damper on a duct that brings fresh air to the furnace return plenum. When the timer calls for ventilation, the exhaust fan comes on, the motorized damper opens, and the furnace fan comes on. Stale air is exhausted from the residence and fresh air is distributed throughout the home. See Figures 5D-1, 5D-2 and 5D-3.

Whole House Ventilation Approaches for Single Family Construction (Five units or less)

Four different approaches are approved for whole house ventilation in single family construction: 1) Single Family Integrated Spot and Whole House Ventilation; 2) Single Family Continuous Ventilation; 3) Single Family Discrete Spot and Whole House Ventilation; and 4) Single Family Ventilation Integrated With Forced Air System.

Table 5.3 gives minimum flow rates for intermittent systems. For continuous systems, minimum flow for the home is 20 CFM per bathroom plus 25 CFM for the kitchen.

Table 5.3
SINGLE FAMILY INTERMITTENT VENTILATION

LTSGC 4.3.1, Table B

Number of Bedrooms	Minimum Certified Fan Flow @ 0.25" w.g.	Maximum Certified Fan Flow @ 0.25" w.g.
2 or less	50 CFM	75 CFM
3	80 CFM	120 CFM
4	100 CFM	150 CFM
5	120 CFM	180 CFM

Single Family Integrated Spot and Whole House Ventilation (Intermittent)

A whole house fan does double duty as a spot ventilator. The spot ventilation control turns on the fan whenever spot ventilation is needed. A 24-hour timer turns on the fan for the required 8-hour ventilation period each day. See Figures 5B-1 and 5B-2.

Single Family Continuous Ventilation

A whole house fan with pickups in each bath and the kitchen runs continuously. The fan is sized to provide a minimum of 20 CFM per bathroom and 25 CFM for the kitchen, but no more than 0.5 air changes per hour.

Another variation is a whole house fan that runs continuously to provide whole house ventilation and also provides spot ventilation for the bathroom in which it is installed. The other bathrooms and kitchen are served by separate spot ventilators. The whole house fan is sized to provide the greater of the minimum spot ventilation rate for the bathroom (50 CFM) or the minimum continuous ventilation rate for the whole house (20 CFM per bath plus 25 CFM for the kitchen).

Single Family Discrete Spot and Whole House Ventilation (Intermittent)

The whole house fan, controlled by a 24-hour timer and manual switch, is completely separate from the spot ventilators. See Figures 5C-1 and 5C-2.

Single Family Ventilation Integrated With the Forced Air System (Intermittent)

If the home has a forced air system, the ventilation system may be integrated with the hearing/cooling system. Installation of this system needs to be coordinated with the HVAC contractor. The electrical contractor may provide the 24-hour timer, the whole house exhaust fan, and a 24-volt control circuit for the furnace fan and

Figure 5B-1
INTEGRATED SPOT/WHOLE HOUSE VENTILATION SYSTEM

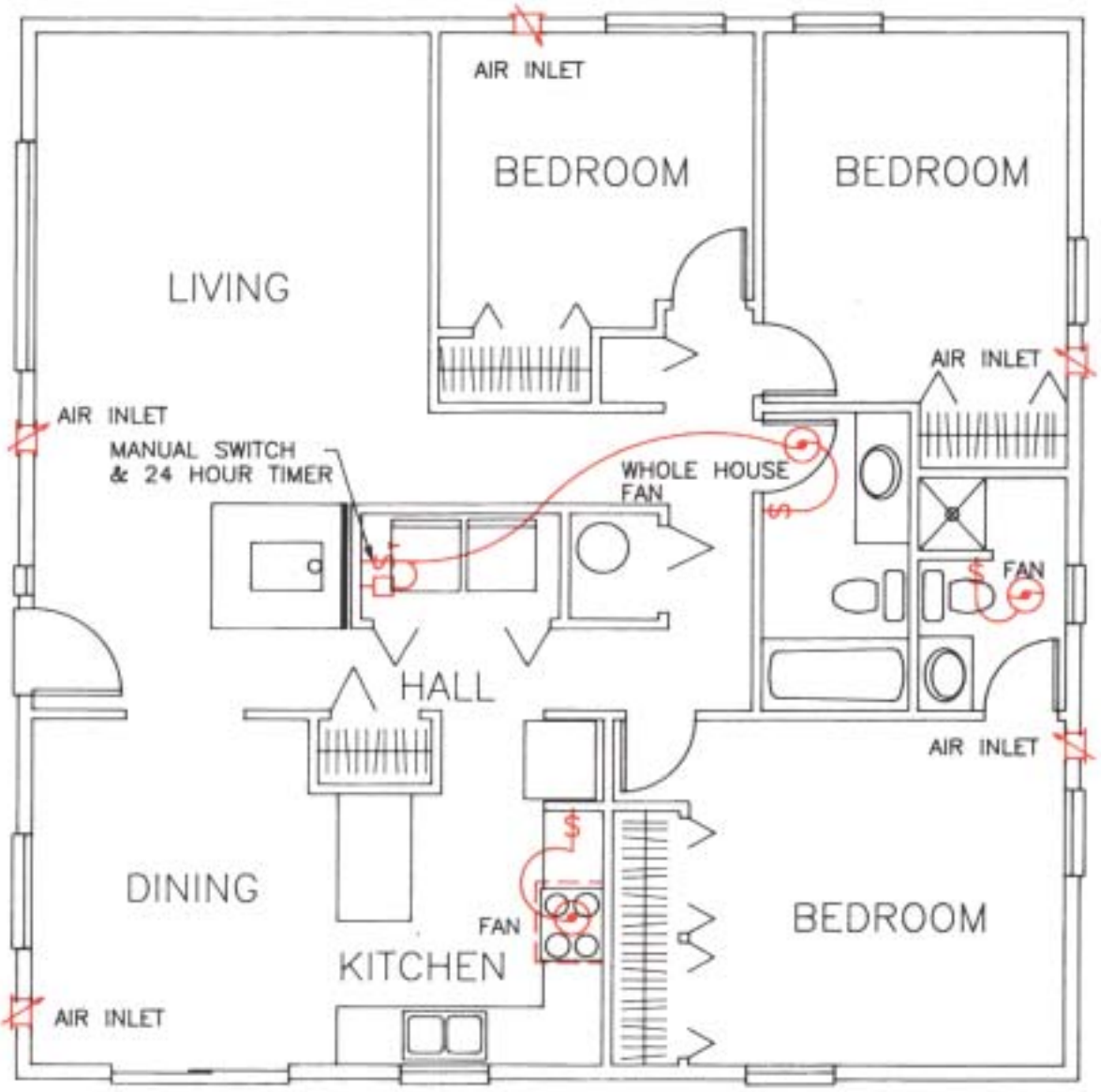


Figure 5B-2
CONTROL WIRING SCHEMATIC: INTEGRATED SPOT/ WHOLE HOUSE VENTILATION SYSTEM

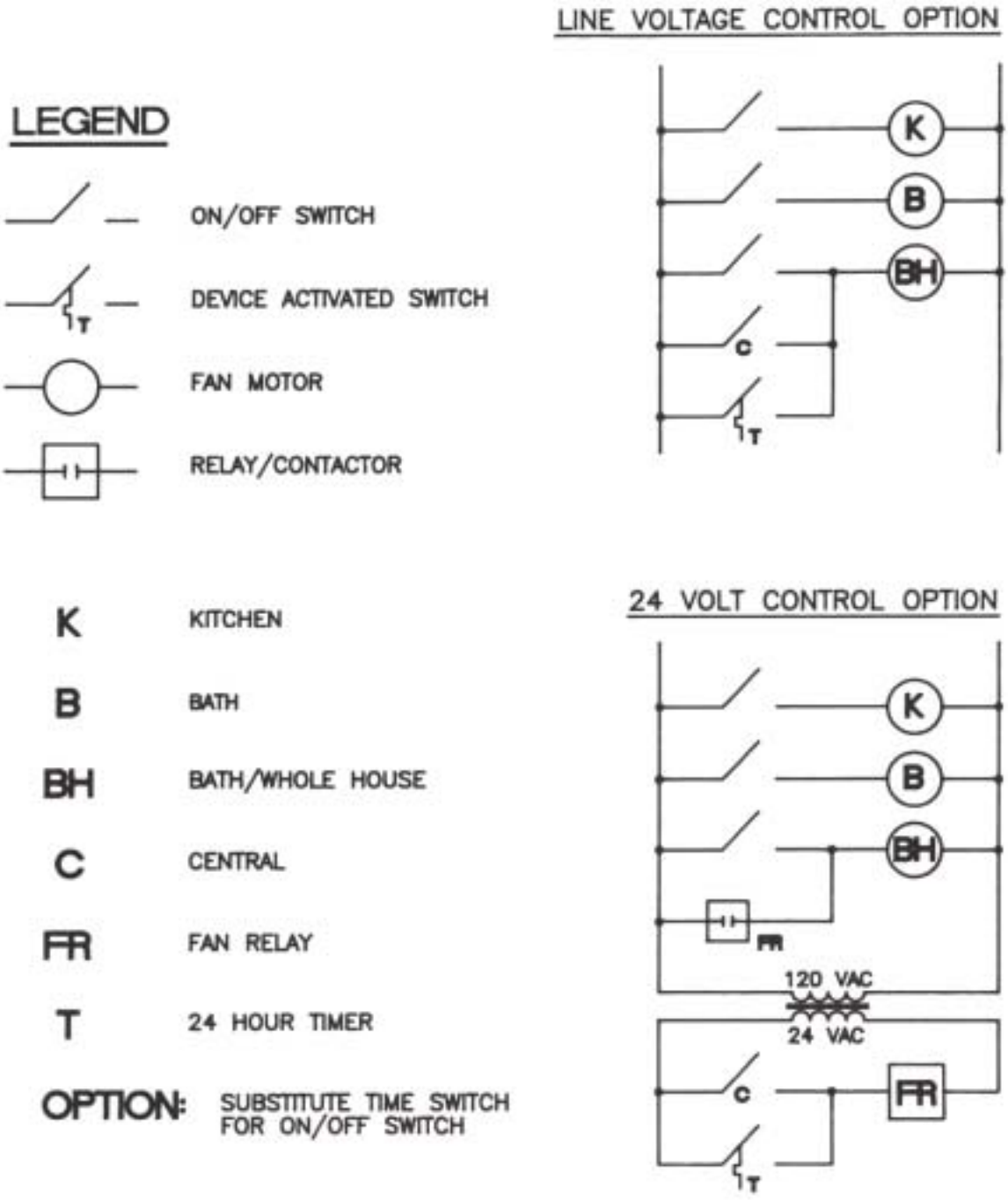
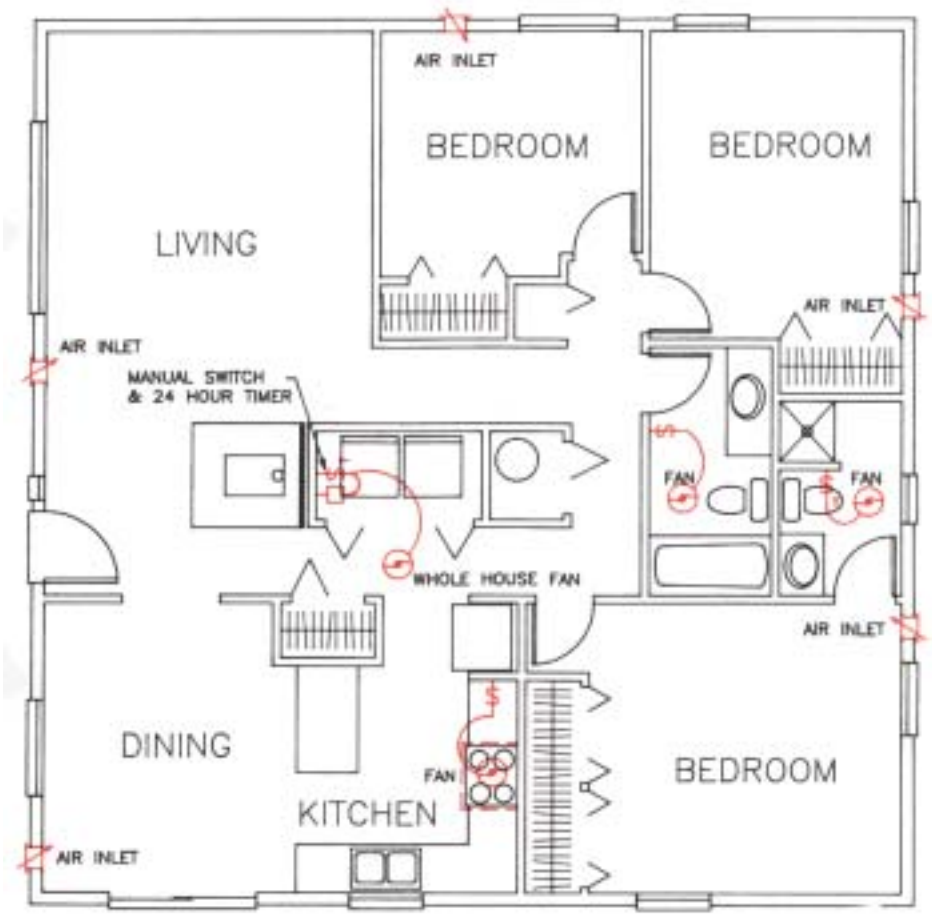


Figure 5C-1
DISCRETE SPOT/WHOLE HOUSE VENTILATION SYSTEM



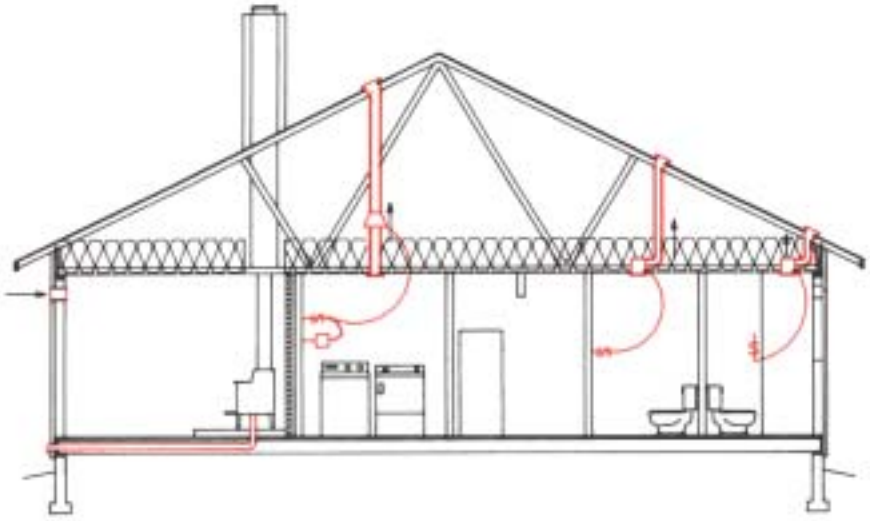


Figure 5C-2
CONTROL WIRING SCHEMATIC: DISCRETE SPOT/ WHOLE HOUSE VENTILATION SYSTEM

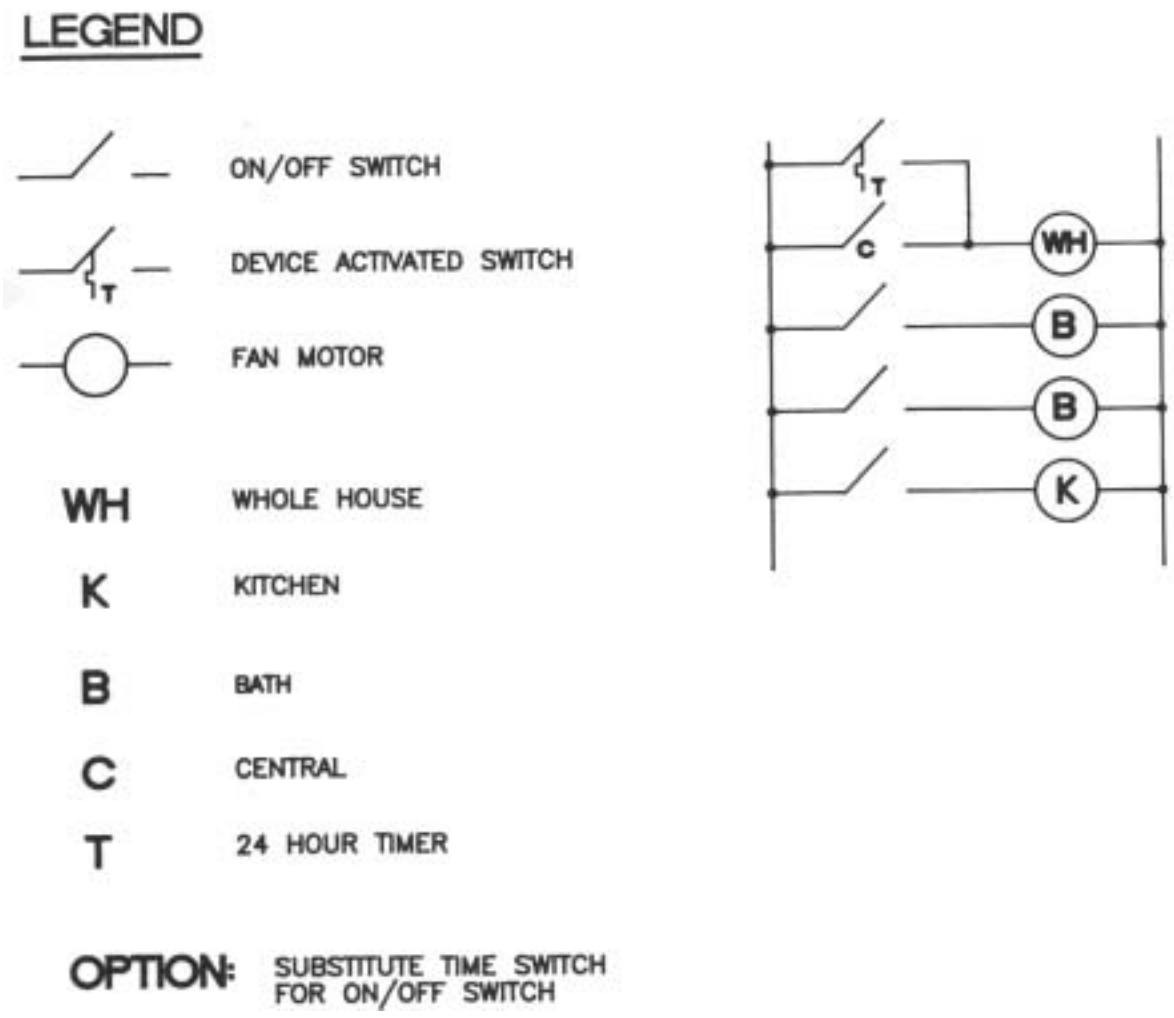
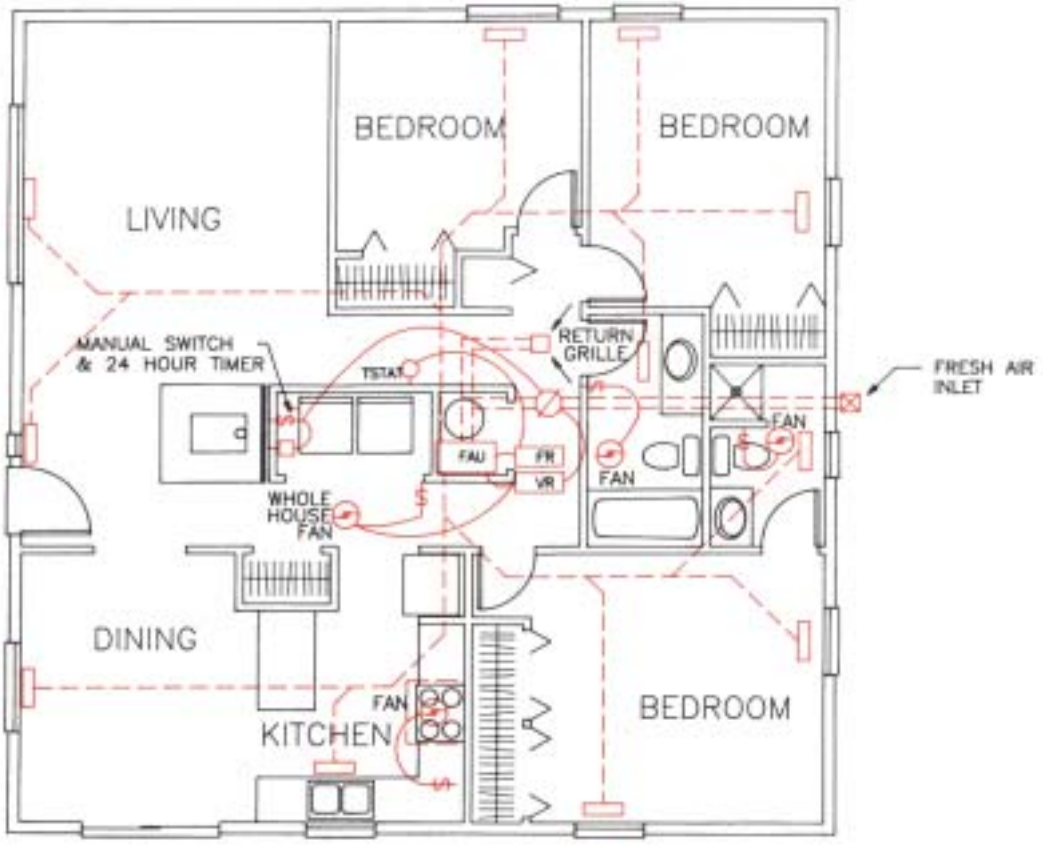


Figure 5D-1
WHOLE HOUSE VENTILATION INTEGRATED WITH FORCED AIR HEATING/COOLING



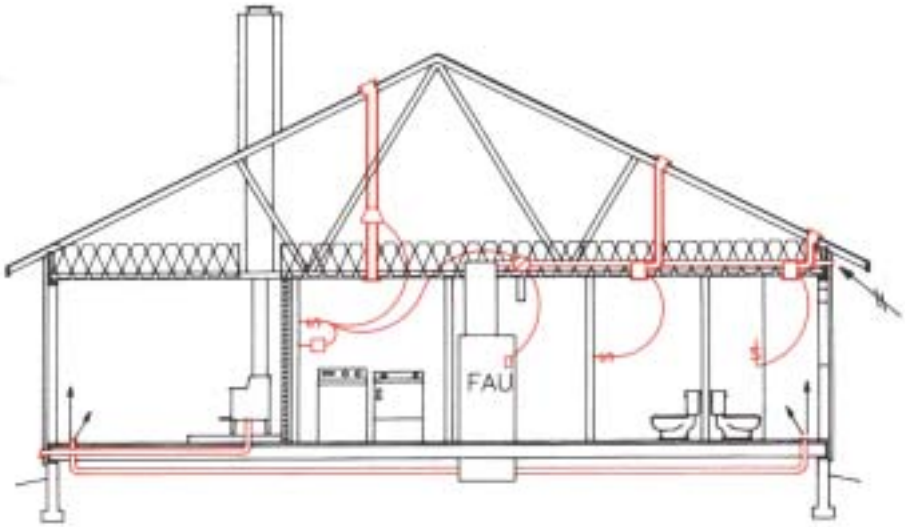
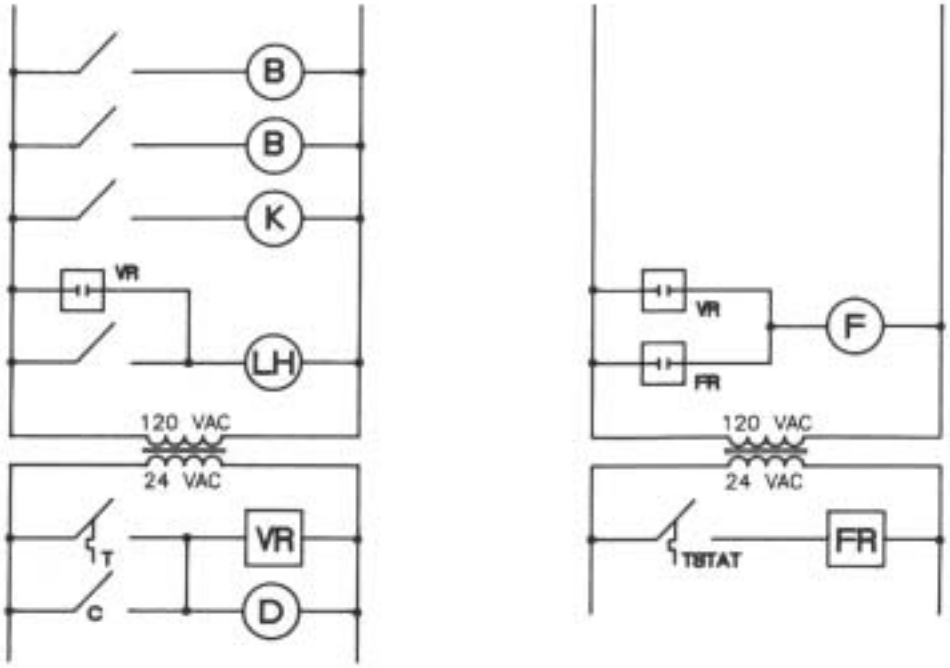


Figure 5D-2
**EXAMPLE 1 CONTROL WIRING SCHEMATIC:
WHOLE HOUSE VENTILATION INTEGRATED
WITH FORCED AIR HEATING/COOLING**

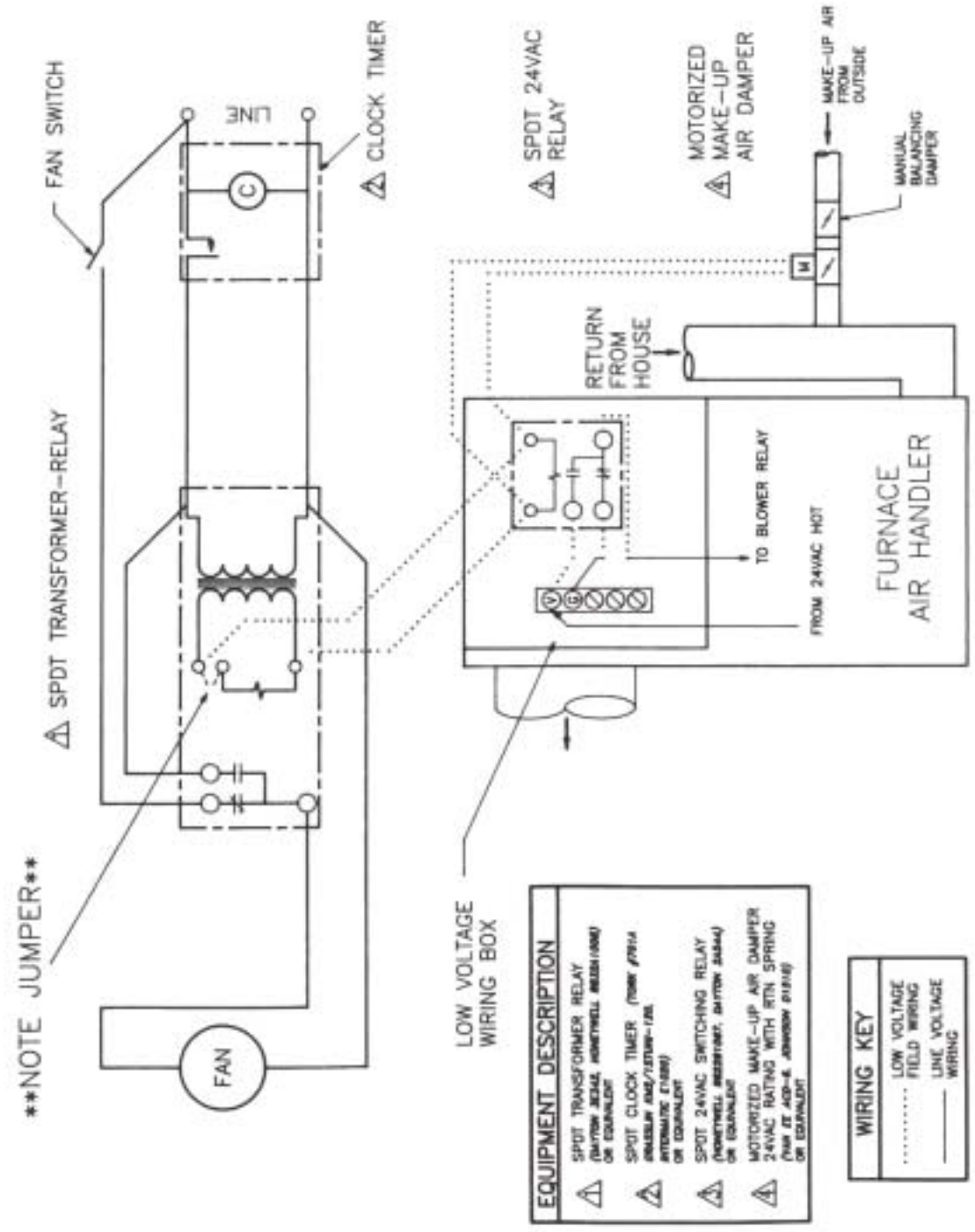


LEGEND

— ON/OFF SWITCH	K	KITCHEN	F	FURNACE FAN
— DEVICE ACTIVATED SWITCH (T)	LH	LAUNDRY/WHOLE HOUSE	FR	FAN RELAY
FAN MOTOR	B	BATH	TSTAT	THERMOSTAT
RELAY/CONTACTOR	B	BATH	T	24 HOUR TIMER
	VR	VENTILATION RELAY	C	CENTRAL
	D	MOTORIZED DAMPER		

OPTION: SUBSTITUTE TIME SWITCH FOR ON/OFF SWITCH

Figure 5D-3
EXAMPLE 2 CONTROL WIRING SCHEMATIC: WHOLE HOUSE VENTILATION INTEGRATED WITH FORCED AIR HEATING/COOLING



motorized damper. The HVAC contractor may provide the final furnace and damper hookups.

The whole house exhaust fan must meet CFM requirements (continuous or intermittent), be controlled by a 24-hour timer with a manual override switch, and be set to provide a minimum ventilation period of 8 hours per day. The 24-hour timer also controls the furnace fan and a motorized damper on a duct that brings fresh air to the furnace return plenum. When the timer calls for ventilation, the exhaust fan comes on, the motorized damper opens, and the furnace fan comes on. Stale air is exhausted from the residence and fresh air is distributed throughout the home. See Figures 5D-1, 5D-2, and 5D-3.

Spot Ventilation in Super Good Cents Single Family and Multifamily Construction

Table 5.4
SUPER GOOD CENTS SPOT VENTILATION REQUIREMENTS

LTSGC 4.3.4, Table D

Location	Intermittent Spot Ventilation	Continuous Spot Ventilation
Each bath	50 CFM	20 CPM
Kitchen	100 CFM	25 CFM

While some building codes allow operable windows to substitute for spot fans in bathrooms and kitchens, the Super Good Cents program does not. Mechanical exhaust to the outside is required.

Spot ventilation fans may be wired to a light switch or to a separate on/off control. Spring wound or electronic timer switches are recommended, but not required. Timer switches have the double advantages of automatic shut-off and allowing ventilation to continue beyond the time the room is in use.

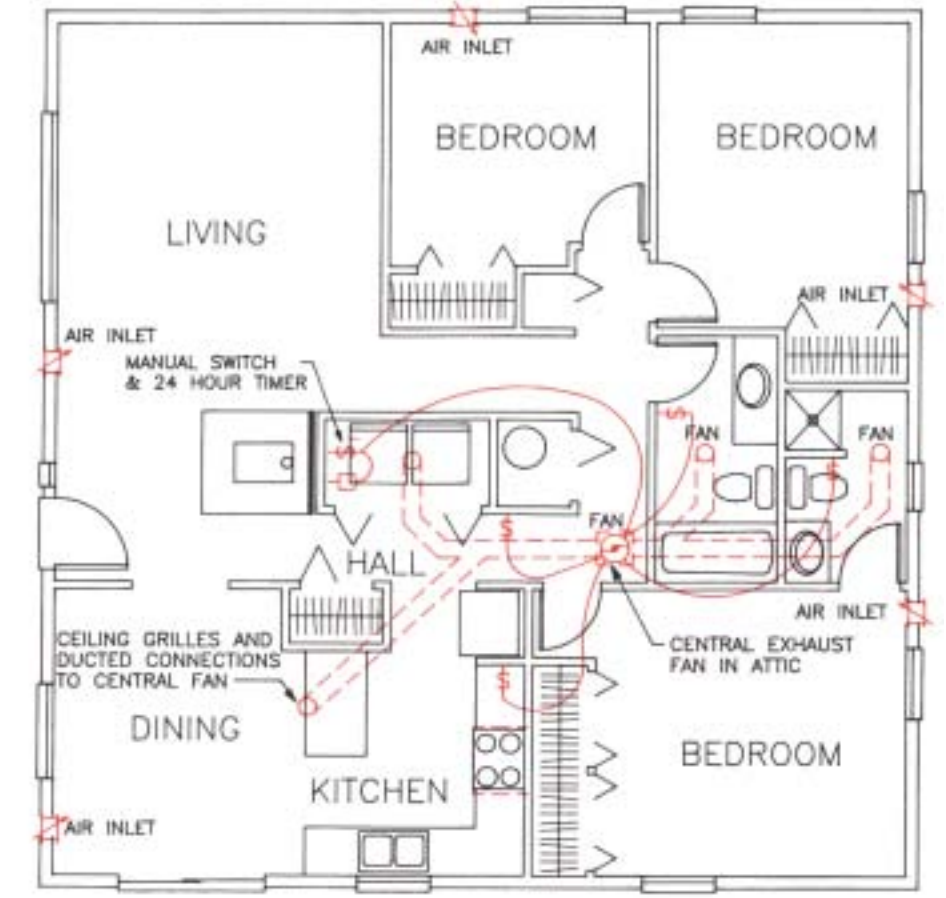
A recirculating range hood alone does not meet kitchen spot ventilation standards. Recirculating range hoods must be accompanied by a separate exhaust pickup in the kitchen.

In some cases a spot ventilator is upgraded to do double duty as the whole house fan. In that case, the fan is controlled in parallel by two devices: the manual switch at the spot fan location and a centrally located 24-hour timer with a manual switch.

Utility room fans are not required by the Super Good Cents program, but they are good practice and are required by some building codes. Utility room fans exhaust moisture and fumes emitted by cleaning compounds stored in utility areas.

Figures 5E-1, 5E-2, 5F-1, 5F-2, and 5G show other ventilation systems the electrical contractor may be called on to wire or install.

Figure 5E-1
REMOTE CENTRAL WHOLE HOUSE VENTILATION SYSTEM



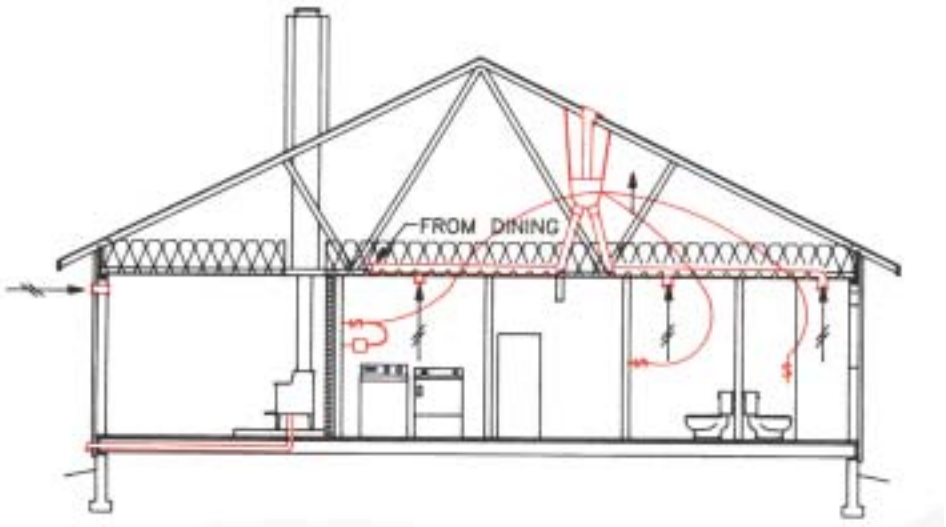


Figure 5E-2
CONTROL WIRING SCHEMATIC:
REMOTE CENTRAL WHOLE HOUSE VENTILATION SYSTEM

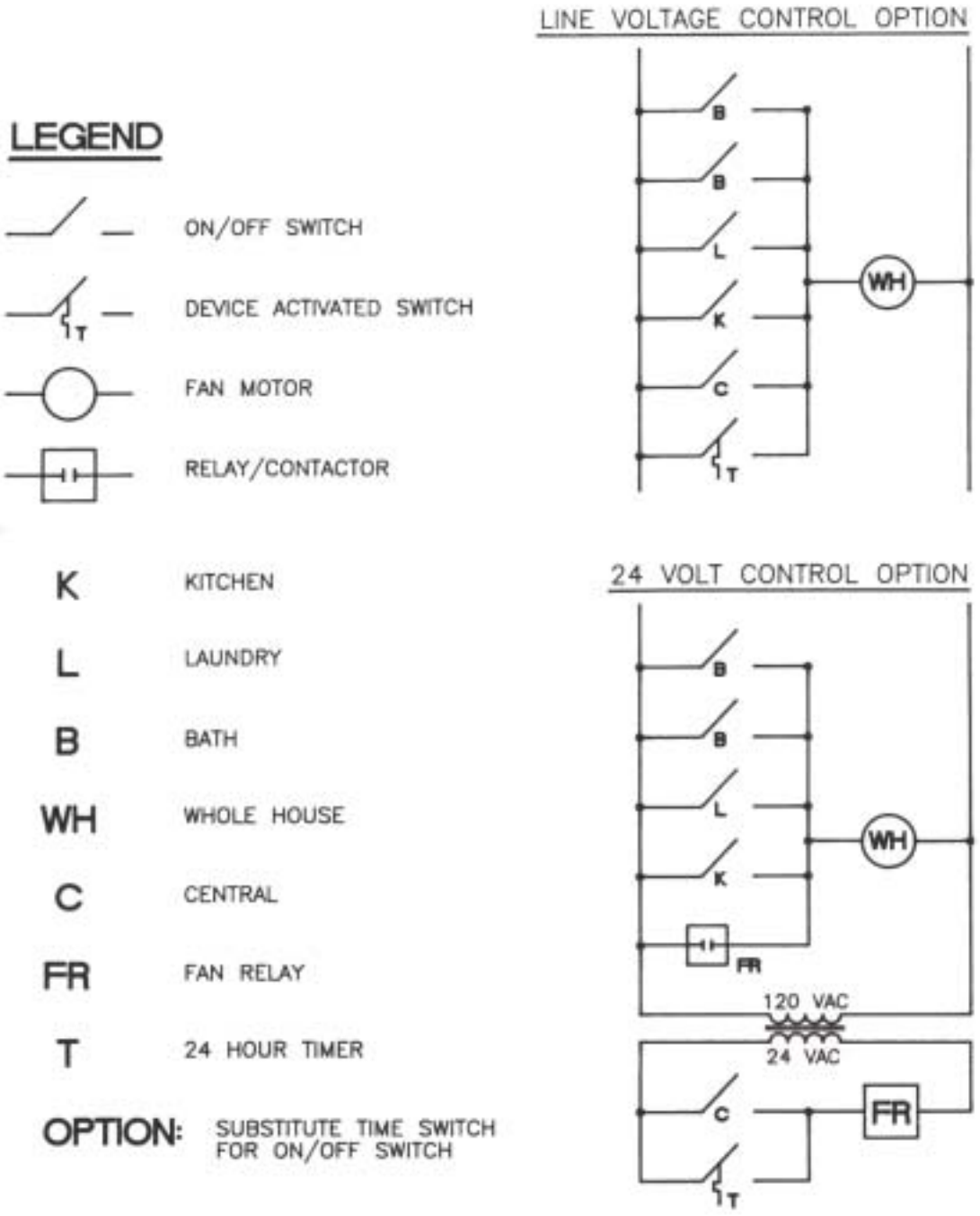
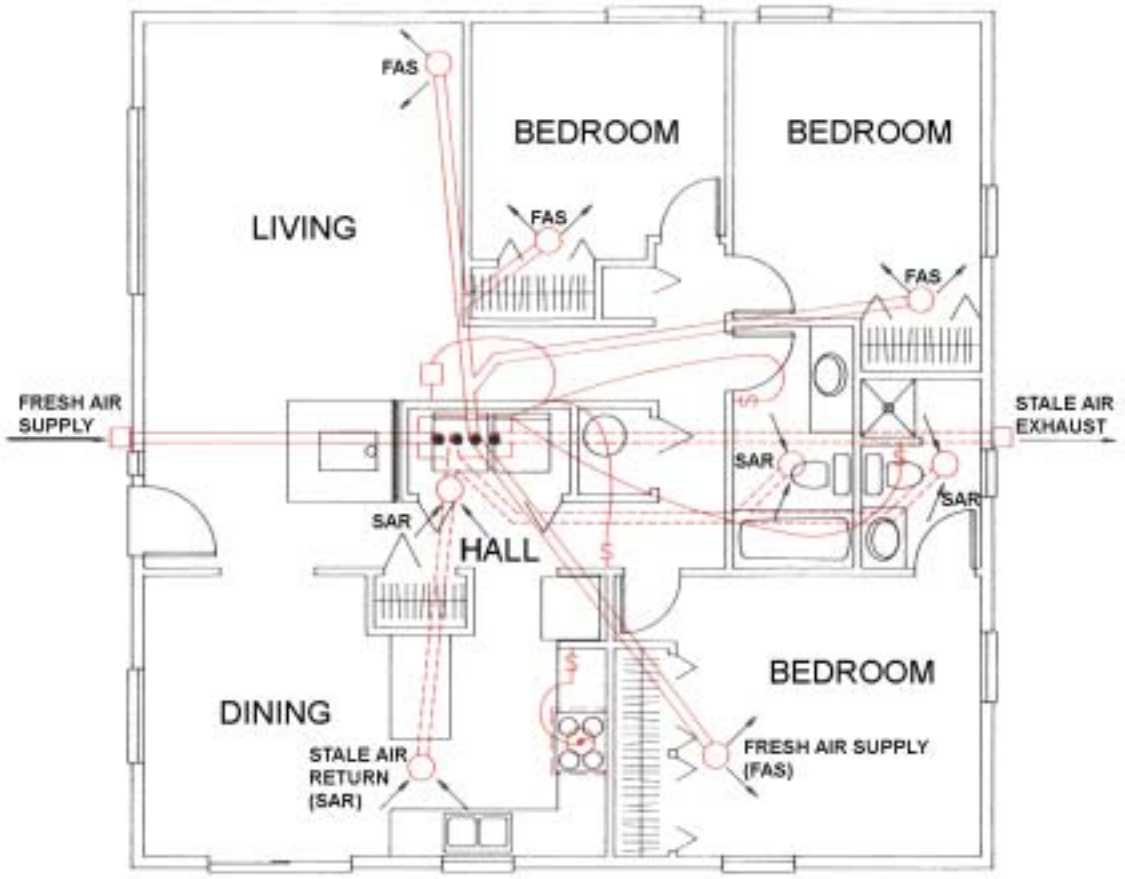


Figure 5F-1
AIR-TO-AIR HEAT EXCHANGER VENTILATON SYSTEM



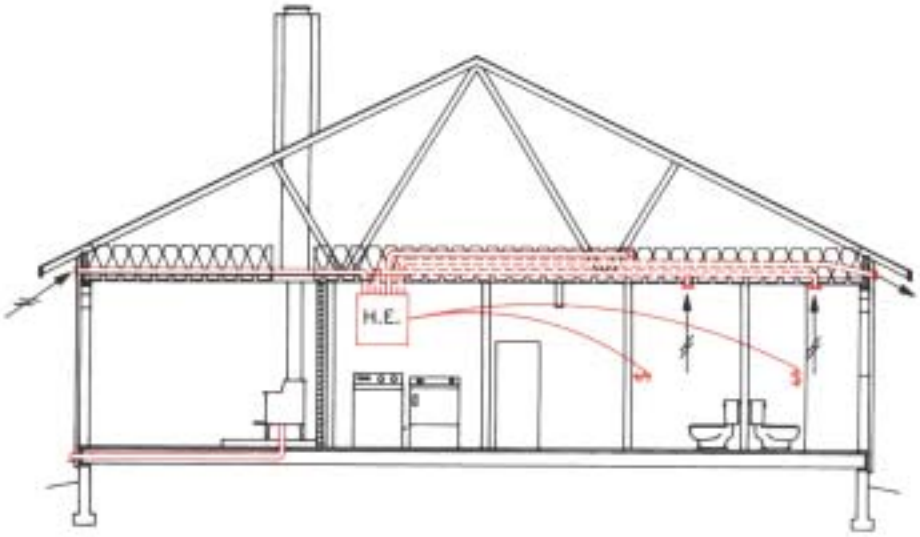


Figure 5F-2
CONTROL WIRING SCHEMATIC:
AIR-TO-AIR HEAT EXCHANGER VENTILATION SYSTEM

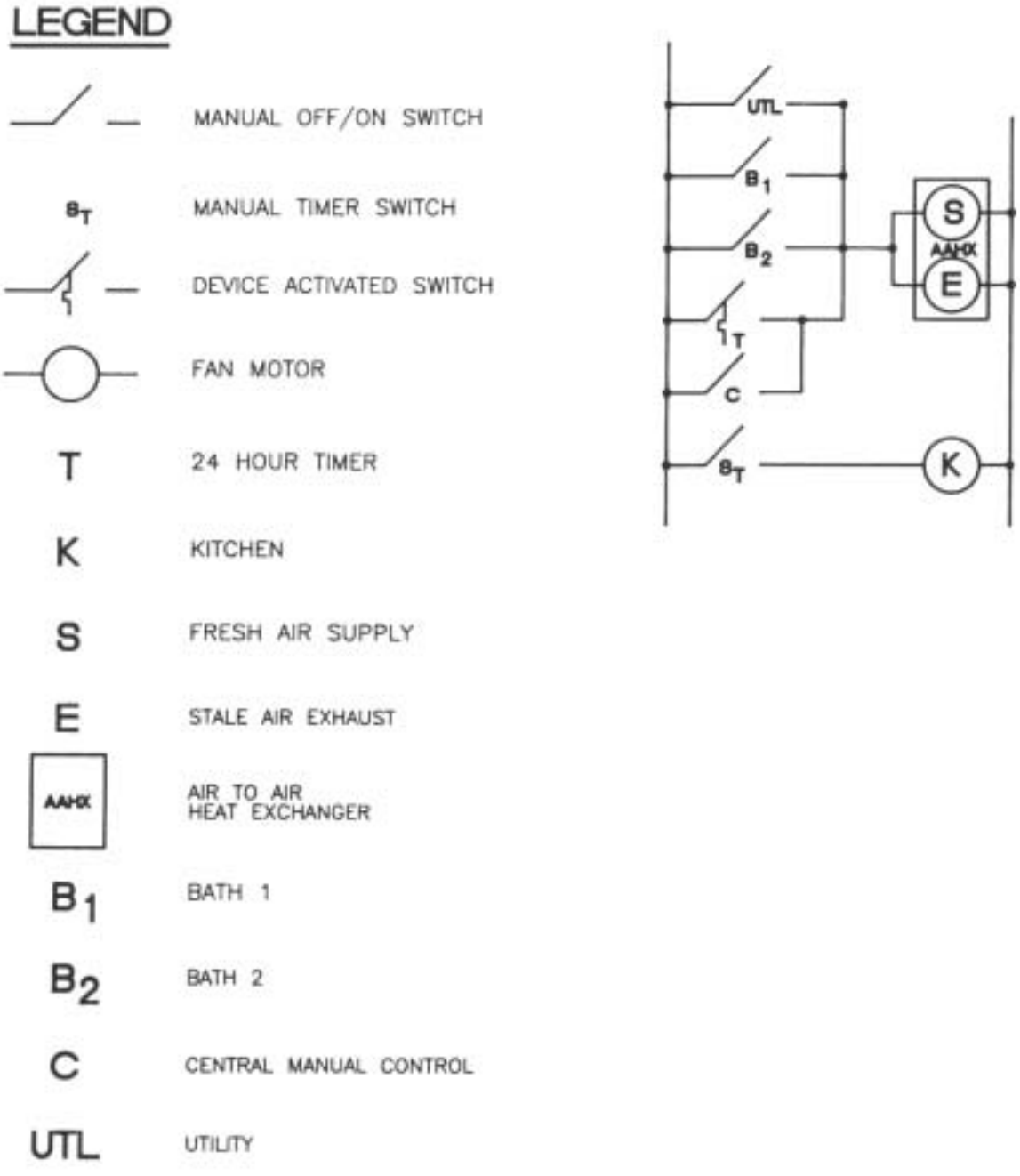


Figure 5G
EXHAUST AIR HEAT PUMP VENTILATION SYSTEM